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**BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES**

Application Number: 09/691,413
Filing Date: October 18, 2000
Appellant(s): LEE ET AL.

Allan W. Watts
For Appellants

EXAMINER'S ANSWER

This is in response to the appeal brief filed 11/15/2005 appealing from the Office action mailed 2/4/2005.

(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellants' statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellants' statement of the grounds of rejection to be reviewed on appeal is correct.

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

5,111,292	KURIACOSE et al	5-1992
2,905,756	GRAHAM	9-1959
5,729,631	WOBER et al	3-1998

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 1, 30-31, 37-39, 44-52, and 54-61 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kuriacose et al. (US patent 5,11,292 cited previously) in view of Graham (US patent 2,905,756 cited previously.)

For Claims 37-39, Kuriacose a block based video coding apparatus (Figs. 1 and 3) comprising means for:

-- generating a predictive DC value of the a DC value of the target block; (column 6, lines 33-46; The DPCM inherently required the predictive value.)

-- performing DPCM coding on the predictive DC value and the DC value of the target block, therefore generating video information; (column 6, lines 33-46)

-- transmitting the video information to a decoder. (Figs. 1 and 3)

However, Kuriacose does not teach the features related to generating a predictive DC value with a selected DC value as recited in the above claims.

Graham teaches a DPCM coding system comprising means for:

-- (a) selecting a value a left pixel and a upper pixel based on a comparison of a first value and a second value, the first value being a difference between values of a left upper pixel and the left pixel, the second value being a difference between DC values of the left upper pixel and the upper pixel; (Fig. 3; column 6, lines 27-47; S_{01} is the upper pixel. S_{10} is the left pixel. S_{11} is the upper left pixel.) wherein

- obtaining a first differential value which is a difference between values of the upper left pixel and the upper block pixel; (Eqs. 3 and 4)

- obtaining a second differential value which is a difference between values of the upper left pixel and the left pixel; (Eqs. 3 and 4)

- comparing the first differential value with the second differential value; (Eqs. 3 and 4)

- selecting the value of the upper pixel, if the first differential value is larger than the second differential value; (Eq. 3)

- selecting the value of the left pixel, if the first differential value is smaller than the second differential value; (Eq. 4)

- wherein the first differential value and second differential value are absolute values; (Eqs. 3 and 4)

-- (b) predicting the selected value as a value of a target pixel, thereby generating a predictive value of the target pixel. (Fig. 3; column 6, lines 27-47; S_{00} is the target pixel.)

It is desirable to have a better compression of an image value array. The objection can be achieved with a better prediction for a target image data value. It was obvious to one of ordinary skill in the art, at the time of the invention to know that the DC components of Kuriacose's blocks form an image value array. Therefore, it would have been obvious to one of ordinary skill in the art, at the time of the invention, to use Graham's adaptive prediction means for Kuriacose's DPCM for coding the DC values of each block because the combination improves compression. In the combination:

-- the values of Graham's left, upper, and upper left pixels are substituted with Kuriacose's DC values of a left block (B3), upper block (B2), and upper left block (B1), respectively, for prediction process.

The above passages also teach the corresponding methods of Claims 1, 30-31, and 33-35.

For Claims 48-52, the above-cited passages of Kuriacose and Graham, their combination, and motivation also teach:

-- the selector circuitry recited in Claims 48, 49; (Fig. 3 of Graham)

-- the differential pulse code modulation coder recited in Claims 48 and 52; (110 of Fig. 3 of Kuriacose);

-- memory circuitry recited in Claim 50; (Fig. 3 of Graham; The computer receives all the three values. Inherently, the computer has a memory to store the values.)

-- the first and second subtractors and the comparator recited in Claim 50; (Fig. 3 of Graham; The computer generates results according to Eqs. 3 and 4. Therefore, the computer has the components.)

-- the absolute value calculator recited in Claim 51. (Fig. 3 of Graham; The computer generates results according to Eqs. 3 and 4. Therefore, the computer has the component.)

The above-cited passages of Kuriacose and Graham, their combination, and motivation therefore also teach the methods of Claims 44-47 corresponding to the apparatuses recited in Claims 48-51.

For Claims 54-57, the above-cited passages of Kuriacose and Graham, their combination, and motivation also teach:

A block based video coding method, comprising the steps of:

-- a) calculating a vertical gradient of DC coefficients of a left upper block (B1) and a left block (B3), and the horizontal gradient of DC coefficients of the left upper block (B1) and a upper block (82); (column 6, lines 33-46 of Kuriacose teaching generating DC coefficients; Eqs. 3 and 4 of Graham teaching calculating gradients; their combination teaching this feature)

-- b) comparing the vertical gradient with the horizontal gradient; (Eqs. 3 and 4 of Graham teaching said comparing; combination of Kuriacose and Graham teaching this feature)

-- c) selecting one of the UC coefficients of the left block (B3) and the upper block (B2) as the predictive DC coefficient of a target block (B); (Eqs. 3 and 4 of Graham teaching said selecting; combination of Kuriacose and Graham teaching this feature)

-- wherein said step c) includes the steps o f:

- c1) selecting the DC coefficient (DC_B2) of the upper block as the predicted DC coefficient (DC_P) of the target block if the horizontal gradient is larger than the vertical gradient; (Eq. 3 of Graham; combination of Kuriacose and Graham teaching this feature)

- c2) selecting the DC coefficient (DC_B3) of the left block as the predicted DC coefficient (DC_P) of the target block if the horizontal gradient is smaller than or equal to the vertical gradient; (Eq. 4 of Graham; combination of Kuriacose and Graham teaching this feature)

-- wherein the horizontal gradient and the vertical gradient are absolute values. (Eqs. 3 and 4 of Graham)

-- d) performing a differential pulse code modulation (DPCM) coding on the predictive DC coefficient (DC_P) and the DC coefficient (DC_B) of the target block, thereby generating prediction error (DC_T); (column 6, lines 33-46 of Kuriacose)

-- e) transmitting the prediction error to a decoder. (Figs. 1 and 3 of Kuriacose)

For Claims 58-61, Kuriacose a block based video coding apparatus (Figs. 1 and 3) comprising:

-- a DCT portion for receiving texture data, performing a discrete cosine transform (DCT) for the texture data, and outputting DCT coefficients including DC coefficients and AC coefficients; (column 5, line 46 to column 6, line 46; column 7, lines 9-30; Fig. 3A)

-- a DPCM coder for performing a differential pulse code modulation (DPCM) on the predictive DC coefficient (DC_P) and the DC coefficient (DC_B) of the target block, thereby generating prediction error (DC_T) and transmitting the prediction error to a decoder. (column 6, lines 33-46)

However, Kuriacose does not teach the features related to generating a predictive DC value with a selected DC value as recited in the above claims.

Graham teaches a DPCM coding system comprising means for:

-- a coefficient storage portion for temporarily storing the coefficients of the three adjacent values including the left upper value, the upper value and the left value and outputting the values; (column 5, lines 32-74; The delays 45, 46, and 44 are the storage portions that hold (store) temporarily the DC coefficients.)

-- a predictive value selector for receiving the values of said three adjacent values, selecting the predicted values of the target value between the upper value and the left value, and outputting the predicted value; (Fig. 3; column 6, lines 27-47; S_{01} is the upper pixel. S_{10} is the left pixel. S_{11} is the upper left pixel.)

-- wherein said predictive value selector comprises:

-- a first substractor in communication with the coefficient storage portion for determining the vertical gradient between the values of the left upper value and the left value; (Eqs. 3 and 4)

-- a second substractor in communication with the coefficient storage portion for determining the horizontal gradient between the left upper value and the upper value; (Eqs. 3 and 4)

-- a comparator in communication with the first and second subtractors for comparing the vertical gradient with the horizontal gradient; (Eqs. 3 and 4)

-- an absolute value calculator in communication with at least one of the first and the second subtractors. (Eqs. 3 and 4)

It is desirable to have a better compression of an image value array. The objection can be achieved with a better prediction for a target image data value. It was obvious to one of ordinary skill in the art, at the time of the invention to know that the DC components of Kuriacose's blocks form an image value array. Therefore, it would have been obvious to one of ordinary skill in the art, at the time of the invention, to use Graham's adaptive prediction means for Kuriacose's DPCM for coding the DC values of each block because the combination improves compression. In the combination:

-- a DC coefficient storage portion for temporarily storing the DC coefficients of the three adjacent blocks including the left upper block (B1), the upper block (B2) and the left block (B3) and outputting the DC coefficients;

-- a predictive block selector for receiving the DC coefficients of said three adjacent blocks, selecting the predicted DC coefficients of the target block between the DC coefficient (DC_B2) of the upper block and the DC coefficient (DC_B3) of the left block, and outputting the predicted DC coefficient;

-- wherein said predictive block selector comprises:

-- a first substractor in communication with the DC coefficient storage portion for determining the vertical gradient between the DC coefficient of the left upper block (B1) and the DC coefficient of the left block (B3);

-- a second substractor in communication with DC coefficient storage portion for determining the horizontal gradient between the DC coefficient of the left upper block (B1) and the DC coefficient of the upper block (B2);

-- a comparator in communication with the first and second subtractors for comparing the vertical gradient with the horizontal gradient;

-- an absolute value calculator in communication with at least one of the first and the second subtractors.

(10) Response to Argument

1. Overview of the Examiner's rejections based on Kuriacose et al. (US patent 5,11,292) in view of Graham (US patent 2,905,756)

The Examiner rejected Claims 1, 30-31, 37-39, 44-52, and 54-61 under 35 U.S.C. 103(a) as being unpatentable over Kuriacose et al. (US patent 5,11,292) in view of Graham (US patent 2,905,756.) **In these rejections, Kuriacose is the primary reference. Graham is the secondary reference that is used to remedy some deficiency of Kuriacose.**

Kuriacose teaches in FIG. 3 an encoding/decoding system which processes a single video input signal with the luminance and chrominance components compressed separately. The video input signal can be a series of frames. (column 3, lines 20-22) The video signal is compressed in an MPEG-like format in which the video signal is processed with DCT and quantization in block 109 and is coded with DPCM and VCL in block 110. Elements 104 and 105 are for computing forward and backward motion vectors respectively.

The video input signal consists of macroblocks. Each macroblock MBi includes four luminance blocks, one U chrominance block and one V chrominance block. See FIG. 2. A block represents a matrix of pixels, e.g., 8 x 8, over which a discreet cosine transform (DCT) is performed. The four luminance blocks are a 2 x 2 matrix of contiguous luminance blocks

representing, e.g., a 16 x 16 pixel matrix. Evidently, the macroblock of the luminance component is of a 16 x 16 pixel size and is divided into four smaller 8 x 8 blocks which are subblocks with respective to the macroblock. The block coefficients are provided one block at a time with the DCT DC coefficient occurring first followed by respective DCT AC coefficients.

Kuriacose's teaching, which meets the requirements of claims of the present application, is in the portion how I frames are coded. During I frame compression, the subtrahend input of the subtracter 108 is held at a zero value so that data passes through the subtracter 108 unaltered. This data is applied to the DCT and quantizer element 109 which provides quantized transform coefficients to elements 110. Element 110 performs two functions during I frame compression. First it performs differential (DPCM) coding of the DC coefficients generated by element 109. It then variable length encodes (VLC) the differentially coded DC coefficients and zero run and variable length encodes the AC coefficients generated by element 109.

Let us see how the DPCM operate with using Fig. A below as an example. Fig. A shows an I frame which has 16 macroblocks (a 4 x 4 macroblock array) of the luminance component of a video signal. Each macroblock has 4 blocks (a 2 x 2 array.) Each block has 8 x 8 pixels and is applied to the DCT and quantizer element 109 which provides quantized transform coefficients to elements 110. The DC coefficients of the blocks are listed in Fig. B below. Element 110 performs differential (DPCM) coding of the DC coefficients shown in Fig. B as follows:

-- (a) code $DC_{1,1}$ directly;

-- (b) predict $DC_{1,2}$ with $DC_{1,1}$ and code the error of this prediction which is ($DC_{1,2}$ - $DC_{1,1}$);

-- (c) predict $DC_{1,j+1}$ with $DC_{1,j}$ and code the error until the end of the line;

-- (d) code DC $_{i+1,1}$ directly or predict DC $_{i+1,1}$ with DC $_{i,1}$ and code the error of this prediction which is (DC $_{i+1,1}$ - DC $_{i,1}$);

-- (e) predict DC $_{i+1,j+1}$ with DC $_{i+1,j}$ and code the error until the end of the line;

-- (f) repeat above until the last row of DC coefficients.

For example, if a series of DC values are 10, 12, 7, 8, 6, 5, 4, and 11. The DPCM at first codes the value "10". It then uses 10 as the predicted value for the second value "12", and codes the difference of the actual second value and the predicted value. That is 12-10 = 2. Evidently, Kuriacose teaches coding DC values with predictive DC values.

Kuriacose explicitly teaches coding the AC coefficients generated by element 109 differently with zero run and variable length, but not DPCM with a reason well known to one of ordinary skill in the art, at the time of the invention: **the DC coefficients arranged in an array represents a reduced, average version of the original frame.** Fig. B below is a reduced, average version of Fig. A. As an example, the way DC coefficients form an array as an image is shown in Fig. 6B of Wober et al. (US patent 5,729,631) as pointed out in one previous Office Action. A reduced, average version of the original frame still preserves similar spatial correlation of the original frame. The spatial correlation makes DPCM workable for reducing the total bit amount of the resultant coded data after DPCM. This was also obvious to one of ordinary skill in the art of image compression, at the time of the invention.

As pointed out in the Examiner's previous Office Action, Kuriacose does not teach the features related to generating a predictive DC value with a selected DC value from its adjacent blocks. This deficiency can be obviously remedied with the teaching of Graham. It is also well known to one of ordinary skill in the art, at the time of the invention that the spatial correlation of

a picture is two dimensional, as evident with Graham's teaching: a pixel is correlated to its adjacent pixels in the left and right as well as those at the top and bottom. The more correlation between two pixels is, the less the prediction error (difference) is. Coding a pixel with a smaller predicted-error signal results a better compression because less data amount (entropy) is generated. **Graham explicitly states the advantage of better compression with adaptive prediction based on the direction of constant brightness lines (Graham: column 2, lines 10-50) for selecting a smaller predicted-error for coding.** Graham's teaching makes use of the nature of two dimensional spatial correlation of a picture. Graham especially teaches a DPCM coding system comprising means for:

-- a coefficient storage portion for temporarily storing the coefficients of the three adjacent values including the left upper value, the upper value and the left value and outputting the values; (column 5, lines 32-74; The delays 45, 46, and 44 are the storage portions that hold (store) temporarily the picture coefficients.)

-- a predictive value selector for receiving the values of said three adjacent values, selecting the predicted values of the target value between the upper value and the left value, and outputting the predicted value. (Fig. 3; column 6, lines 27-47; S_{01} is the upper pixel. S_{10} is the left pixel. S_{11} is the upper left pixel.)

Because both Kuriacose and Graham teach using DPCM to code picture signals for compressing signal amount for transmission and with the explicit advantage given by Graham in column 2, lines 10-50, the combination of Kuriacose and Graham obviously teaches Claims 1, 30-31, 37-39, 44-52, and 54-61 as explained above and in the previous Office Actions.

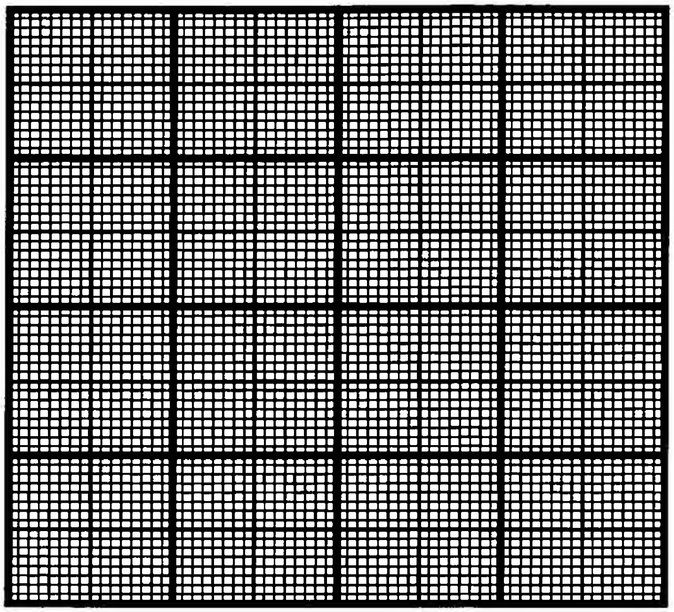

Fig. A.

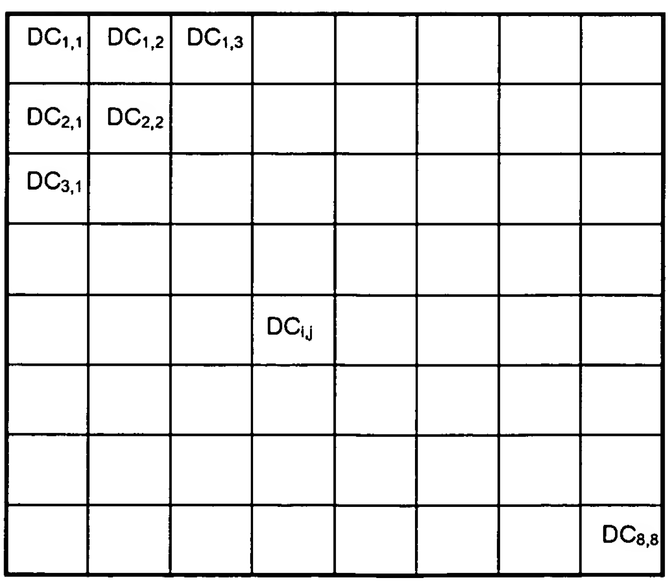

Fig. B

2. Issues under review

a. Appellants' argument -- The present invention is a significant improvement in an area of technology that is limited to applications using discrete cosine transforms and DC coefficients or DC values. Television has very important impact on human society and a tremendous value. Video coding is important in TV signal transmission. Usage of DCT and predicting DC coefficients for compressing TV signal has been known for a long time. And if the invention was obvious, someone else would have invented it.

Examiner's response -- The argument is not pervasive. The improvement to video coding was collective efforts of those with skill in the art of image compression in its development history. Some contributed more, some less. Although usage of adaptively predicting DC coefficients can provide some advantages, it does not present a revolutionary breakthrough in image compression. One can argue with equally pervasive reason in the other way that because the claimed invention was obvious, no one else would have filed any patent application even he/she thought of it. There are no other evidences, such as business success induced only by the Appellants' special prediction of the DC coefficients in video coding, to prove the non-obviousness of their concept.

Whether there is an issued patent or not is not relevant information about the obviousness of the claimed invention. As pointed out before, one of ordinary skill in the art of image compression, at the time of the invention, would know (1) both Kuriacose et al. and Graham, (2) that a DC value is an average value of a block, and (3) that the collection of DC

values represents a reduced image of the original image. Therefore, said one of ordinary skill in the art would modify Kuriacose's DPCM coding with Graham's adaptive prediction approach to take the advantage of better compression as pointed out by Graham. This clearly pointed out the obviousness of the appealed claims.

b. Appellants' argument -- Graham is not reasonably pertinent to the particular problem addressed by the present invention. When taken as a whole, Graham has nothing to do with the specific problem addressed by the present invention, namely, improving the accuracy or efficiency with which DC values or DC coefficients are predicted for blocks of pixel values upon which DCT manipulations have been performed. Consequently, Graham is outside of the field of the endeavor of the present invention, is not reasonably pertinent to the problem with which the present invention is concerned, and would not have logically commended itself to the inventors attention in considering the problem addressed by the present invention.

Examiner's response -- The Examiner disagreed with this conclusion. The present application is for image compression and specifically for coding a video that have a series of frame. Accordingly, it requires coding a frame. As correctly pointed out by the appellants, Graham teaches a method and apparatus for reducing television bandwidth with transmitting the difference between a pixel and a value predicted from its neighbor. This reduces the total amount of information that must be transmitted, thus reducing the required bandwidth. This reduction is an image compression process. Evidently, both the present application and Graham aimed at improving compression. Therefore, Graham is reasonably pertinent to the

problem addressed by the present invention. Furthermore, the Kuriacose is also for image compression and for its optimization. For example, Kuriacose selectively codes DC values associated with blocks in I frames with a coding approach different from those coding AC values of I frames. The implicit reason is a better compression. **Therefore, all the present application, Graham, and Kuriacose address the common problem of image compression.**

As explained above in the overview section, DC values of the blocks forms a low-resolution image with each DC value representing a pixel value in the low-resolution image. **Adaptive prediction of pixel values taught by Graham thus address the same problem of better prediction of values of a two dimensional array.**

As shown in the Office Action dated 2/4/2005, Kuriacose teaches all the features except those related to generating a predictive DC value with a selected DC value. Because Graham's teaching is pertinent to the problem addressed by both Kuriacose and the present invention, Graham's teaching can be used to modify Kuriacose to gain the advantage for better compression.

c. Appellants' argument -- There is no motivation within Graham to combine it with another reference to arrive at the present invention and such a modification of Graham would change its principle of operation. Since Graham does not contemplate DCT which is performed on blocks of pixels, DC coefficients, or DC values, Graham does not anticipate the problem addressed by the present invention and does nothing to suggest the desirability of predicting DC coefficients or DC values of blocks. There is no motivation within Graham to combine it with another reference to arrive at the present invention. In addition, a proposed modification to a

prior art reference cannot change principle of operation of the reference. If Graham were modified to arrive at the present invention, such a modification would change the principle of operation of Graham, since instead of predicting individual pixels, DC values of blocks would be predicted after performing DCT operations.

Examiner's response -- First, the Examiner likes to point out that Graham is not the primary reference and the Examiner did not state that one of ordinary skill in the art of image compression, at the time of the invention, would modify Graham to realize the claimed invention. **It is that Graham's teaching is used to modify Kuriacose's DPCM coding of DC coefficients to arrive at the present invention. Kuriacose's DPCM coding of DC coefficients is at one-value-by-one-value basis, namely predicting the DC value of a block (a single value associated with a block.) Graham's teaching is also a prediction coding of one-value-by-one-value basis. The motivation is explicitly provided in Graham (column 2, lines 10-50.)**

Again, as explained above in the overview section, DC values of the blocks forms a low- resolution image with each DC value representing a pixel value in the low-resolution image. Adaptive prediction of pixel values taught by Graham thus address the same problem of better prediction of values of a two dimensional array at one-value-by-one-value basis. This modification does not change either Kuriacose's nor Graham's principle of operation.

d. Appellants' argument -- There is no motivation within Kuriacose to combine it with Graham or another reference from that time.

Examiner's response -- **The motivation is provided explicitly in Graham not in Kuriacose as stated in the previous Office Action.** Graham explicitly states the advantage of better compression with adaptive prediction based on the direction of constant brightness lines (column 2, lines 10-50.) Because Kuriacose has a deficiency to be fixed, it is obviously that it did not provide the motivation for combination.

e. Appellants' argument -- There is no other suggestion or motivation to combine references or arrive at the present invention.

Examiner's response -- **Since the motivation is provided explicitly in Graham, The Examiner did not need to rely others to teach the motivation.** The argument is not relevant.

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

Wenpeng Chen Wenpeng Chen 7/31/2006

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